A REVIEW ON FREQUENCY HOPPING SPREAD SPECTRUM BASED ANTI-JAMMING IMPROVEMENT WITH ENCRYPTED SPREADING CODES

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Abstract - *Now a days is fully digitalized world and communication is the one of the most important part in modern life. Everywhere digital system are present like railway ,airplanes, command posts, vehicles, satellite, missile launchers, etc. digital signal play very important role in digital communication system. Improvement of signal security and anti-jamming is very important for secure communication system. In preset time many technique are developed for anti-jamming improvement but my attention on Frequency hopping spread spectrum anti-jamming improvement with Encrypted spreading codes. This technique is based on encrypted PN-sequence which is based on frequency hopping spread spectrum modulation technique. This technique give better result in signal anti-jamming in terms of signal-to-noise ratio, throughput and Bit error rate.*

***Key Words:** Frequency hoped Spread Spectrum.PN-sequence, Anti-jamming, Signal to noise ratio, Bit error rate.*

1. INTRODUCTION:

Reliable and real-time communication is essential to the success of military operations, railway, and secure communication. An exhaustive survey has been done which suggests immediate need of a method which should have the capability to predict exact security level of resistance of jamming and ant jamming signal network at each instant. In order to achieve this desired goal we have set certain objectives. So the research objectives are as follows:

i. Handling of signal anti-jamming using frequency hoped spread spectrum.
ii. Handling of imprecise, inaccurate and sparse data for jammed and anti-jammed signal.
iii. The proposed encryption security algorithm is highly reliable.

iv. Researcher needs a unique learning approach that work well, smoothly and stable under all circumstances.

Above mentioned problem statement is formulated in perspective of following problem specification

1. Reduces the transmitted bandwidth.
2. Bit error rate.
3. Signal to noise ratio.

Some basic term which is important for discussions-:

a) Frequency Hopping Spread Spectrum

Frequency hopping is a spread spectrum technique that involves partitioning the allocated frequency band, called the hopping band, into a large number of smaller Sub-bands. These sub bands are also called carrier frequencies, channels, tones, sub channels, or sub-carriers. Transmission is carried out in short bursts on one sub-band at time, hopping from sub-band to sub-band in a pseudo-random fashion after each burst [2].

b) Jamming

The resistance of such demodulators to different types of jamming signals is a very important property. Theoretical analysis is usually performed under simplifying assumptions and used mathematical models neglects influence of receiver's filters, mixers, AGC, etc. Whereas the jamming signals have influence both on radio receiver IIF amplifiers, AGC unit, IF unit, filters, demodulators and so on, all these units interact, and analytical analysis is complicated and imprecise.

c) Basic purpose

The fundamental goal of spread spectrum system is considered as to increase the dimensional characteristic of the signal, hence, to make eavesdropping and jamming more difficult since there are more dimensions of the signal to consider. In fact, the main method of increasing the dimensionality of the signal is to widen the signal's spectral occupancy.

2. LITERATURE REVIEW

In this part, we are presenting literature survey which has been carried out by going through various journals and articles. Section gives brief of all the journals/articles, represents the identified research gap. Finally, we conclude this information about FHSS algorithm and its details are also available on some websites; these are also referred and listed in the reference section.

In[**Hui Hu, Na Wei**, 2009][1]**,**The weaknesses of GPS is more to be jammed, i.e. learning of jamming and anti-jamming of GPS has more. This pepper the researcher is analyzed performance of GPS transmitter and receiver using MATLAB simulation software. They achieves the simulation of C/A jamming and single frequency jamming by building simulation model. They analyzed those experiment that no matter it is C/A jamming bit error rate is increased with increasing the signal to noise ratio. If signal to noise ratio is increased some point the system bit error rate will suddenly rocket up, that indicate system cannot work properly because limit of jamming is very high. *In this paper studied of GPS Jamming and Anti-jamming.*

In [**Rakesh Jha, Hardik Patel, Upena D. Dalal, Wankhede A. Vishal,**2010][3], this paper, they studied the simulation of WIMAX based system of jamming. The system performance was found this type of model is greatly differ with the use of different jamming signal allowing in the cotroal areas to the basic point of view. In this paper discused both type single carrier and multicarrier jamming both are discused in this papper but basic focus on the multicarrier signal jamming with the use of OFDM based physical layer in this papper

simulation is used and the used simulation software is OPNET MODELER 14.5.

After the use this simulation the performance of BPSK and QPSK is better than other modulation scheme.Wimax sector antena given better performance compare to isotropic antena. Throughput is decread and delay is inceasd when the data subcarrier are destroyed. Uplink is more sensitive compare to the downlink,in single carrier and multicarrier both type of signal jamming. *From this paper WiMAX System Simulation and Performance Analysis under the Influence of Jamming.*

In [**Xing Tan and John M. Shea,**2008][4],this paper, they studied the fhss and they apply the EM algorithm for mitigation of multi-access interference (MAI) in asynchronous slow frequency-hopspread spectrum (FHSS)systems that employ binary frequency-shift keying (BFSK) modulation scheme. MAI is occurs if the hopping patterns of the users are not orthogonal. they develop an iterative detection,estimation, and decoding scheme to recover the desired signal in the presence of MAI and recover. They use in transmiter side input, encoder, interleaver, BFSK,frequency hopper,then pass through MAI,WGH then frequency dehopper and in the receaver side mathed filter bank then initial channel estimator, soft demodulator de-interleaveer soft decoder and a feedback of interleaver,channel estimator to soft demodulator.At the output side they use expection maximization algorithum (EM), to estimate the channel parameter.they treat the values of the transmitted symbols for the model.

They used trellis in the BCJR algorithum for the soft demodulator. The finalc onclusion of this model on nonfading and Rayleigh fading channels, the algorithm that we propose significantly improves performancein the presence of strong interferers. this model receaver structure can support 19 users in 100 frequency band, but the conventional receaver support only 2 users. *In this paper an EM Approach to Multiple-Access Interference Mitigation in Asynchronous Slow FHSS Systems.*

In [**Ehab Elsehely and M.I. Sobhy,**1999][5] this paper is basically based on efficient method to identify the

received target pulse in preasense of noise and reasead false jamming signal that that identification is done by using wavelet transform because wavelet transform have a proerty of multiresolution and it is suited for analysing the such multiscale signals,by using the wavelet transform finding the resead target signal. Location of the target pulse local maxima of the wavelet transform. In this paper algorithum is based on the correction and integration of the local maxima of the wavelet coefficients. Applied algorithum is decrease the effect of the jamming signal on the reased pulse. This paper is done by using receivd target pulse is simulated in the prasense of noise and false jamming signal. The final conclusion is that identification a received rader target using multiscale wavelet transform. It is real time application possible by using dsp. *In this paper detection of Radar Target Pulse in the Presence of Noise and Jamming Signal using the Multiscale Wavelet Transform.*

In [**Myeongsu Han, Student Member, IEEE, Takki Yu, Member, IEEE, Jihyung Kim,**2008][6] this paper is basically based on the channel estimation scheme using new jammed pilot detection algoritham for orthogonal frequency divison multiplexing unde the narrow-band jamming. In this method the average mean square error of OFDM symbol both jammed and removed pilot subcarrier analytically. Symbol error rate performance for channel estimation . based on this method algorithm is self able to detect and removed the jammed pilot subcarriers and using the linear interpolation to eliminate the effects of NBJ from the jammed pilot sub-carrier. This paper OFDM channel estimation with jammed pilot detector under narrow-band jamming.

In [**Ashraf Al Sharah, Taiwo Oyedare, Sachin Shetty,**2016][7] this paper mobile Ad-hoc network (MANET) are vulnerable to insider jamming attacks. In present communication system several approach to detect insider jammers. In this paper they focus on smart jamming attacks where the attacker have been detected the insider jamming in a MANET, return to attack based on the knowledge signal. The MANET is a reputation based coalition game to detect insider

jammers. In this system smart jammer where detect and when excluded from group of Ad-hoc combine many smart jamming signal, finally more no jammed signal combine. This combined signal make a not connected algorithm. In this system is clearly say that if number of jammer coalition then greater in the accuracy. This shows that having more jammer nodes in the system coalition would give high jamming impact. *In this paper Colluding Jamming Attack on a Grand Coalition by Aggrieved Nodes.*

In [**Wednel Cadeau, Xiaohua Li, Chengyu Xiong,** 2014][8] this paper is conduct a cross-layer analysis of both the jamming capability of the cognitive- radio-based jammers and the anti-jamming capability of the cognitive radio networks (CRN). They use the Markov chain to model the CRN operations spectrum sensing, channel access and channel switching under jamming. With various jamming models, the jamming probabilities and the throughputs of the CRN are obtained in closed-form expressions. They analysis the result and verified by simulations. The results indicated that the CRN is extremely susceptible to jamming attacks. When they combine jamming attack by increasing the number of white space channels. *From this paper Markov Model Based Jamming and Anti-Jamming Performance Analysis for Cognitive Radio Networks.*

In [**Marc Heddebaut, Virginie Deniau, Jean Rioult, Gregoire Copin,** 2015][9] this paper is focused on the detection of Intentional Electromagnetic Interference (IEMI) superimposed on a radio communication system. It is basically based on safety of the railway system. In railroad network composed of stations, depots, tracks, trains… constitutes one of the major critical infrastructures in industrial countries in Europe. Because of this criticality and of its large deployment, studying the resilience of the railway network regarding intentional electromagnetic interferences (IEMI) is important. This paper considers IEMIs generated by low power electromagnetic jammers operated in railway environments. *From this paper method for detecting jamming signals superimposed on a radio communication.*

Summarized table of above following literature survey are-

Author	Technology based	Remark
Hui Hu, Na Wei	Performance of GPS transmitter and receiver using MATLAB simulation software	Good anti-jamming
Rakesh Jha, Hardik Patel, Upena D. Dalal, Wankhede A. Vishal	WIMAX based system of jamming	Simulation software is based on OPNET MODELER 14.5.
Xing Tan and John M. Shea	Expectation maximization algorithm	Mitigation of multi-access interference
Ehab Elsehely and M.I. Sobhy	Detection of Radar Target Pulse	Identification is done by using wavelet transform
Myeongsu Han, Takki Yu, Jihyung Kim	OFDM channel estimation with jammed pilot detector under narrow-band jamming.	Average mean square error is removed
Ashraf Al Sharah, Taiwo Oyedare, Sachin Shetty	Ad-hoc network (MANET)	Ad-hoc combine many smart jamming signal then removed
Wednel Cadeau, Xiaohua Li, Chengyu Xiong	They use the Markov chain to model the CRN operations spectrum sensing	Performance Analysis for Cognitive Radio Networks.
Marc Heddebaut, Virginie	Method for detecting jamming signals	Detection of Intentional Electromagnetic
Deniau, Jean Rioult, Gregoire Copin	superimposed on a radio communication.	Interference

3. SYSTEM MODEL:

The concept of frequency hopping spread spectrum is in fact quit simple and easy to understand. Each user can still use its conventional modulation. The only difference is that now the carrier frequency can vary over regular intervals. When each user can vary its carrier according to a predetermined, pseudorandom pattern, its evasive signal effectively occupies a broader spectrum and becomes harder to intercept and jam. My concept is based on encrypted PN-sequence which is based on frequency hopping spread spectrum modulation technique. We follow some algorithm step by step which flow step is shown figure 1.
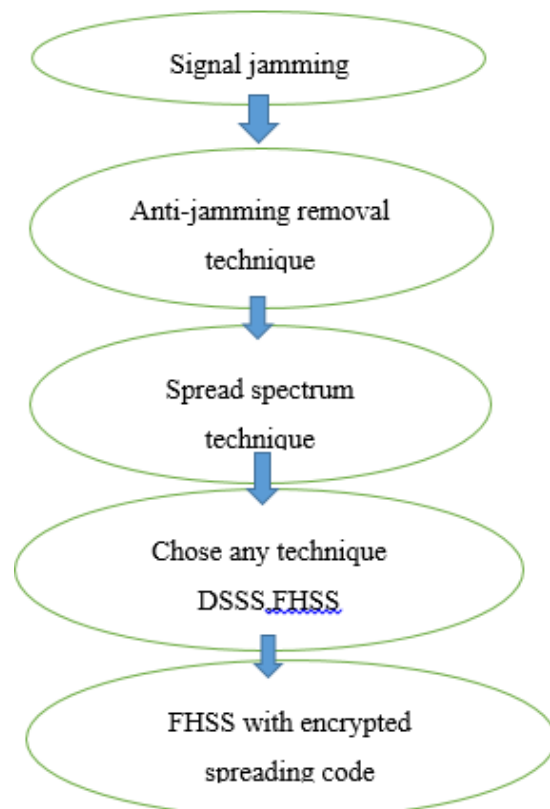

Figure-1

4. CONCLUSION

Many researchers have developed intelligent systems for jamming security and they have been successfully implemented for commercial purpose of communication system. From the above literature survey it seems the intelligent and smart systems are the most appropriate solution for the fast and precise security assessment. Most of the researchers have worked on the GPS jamming, they analyzed those experiment that no matter it is C/A jamming bit error rate is increased with increasing the signal to noise ratio. WIMAX based system of jamming, mobile Ad-hoc network (MANET) are vulnerable to insider jamming attacks, DSP Modulator algorithm, spread spectrum modulator, digital FSK and PSK demodulators and have very good result of resistance of jamming. Finally we say that if encrypted spreading is used then FHSS is giving better result than other jamming technique.

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BIOGRAPHIES

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